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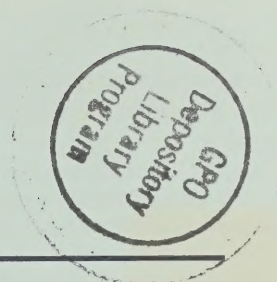
United States
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Dividends From Wood Research



Recent Publications

July–December 1991

Explanation and Instructions

"Dividends From Wood Research" is a semiannual listing of recent publications resulting from wood utilization research at the Forest Products Laboratory (FPL). These publications are produced to encourage and facilitate application of Forest Service research. This issue lists publications received from the printer by the FPL Publications Section between July 1, 1991, and December 31, 1991.

Each publication listed in this brochure is available through at least one of the sources below. For each entry in the brochure, we indicate the primary source for that publication and show you how to obtain a copy.

Available from FPL (indicated by an order number before the title of the publication): Quantities limited. Circle the order number on the blank at the end of the brochure and mail or FAX the blank to FPL.

Available through sales outlets (indicated by the name of the outlet and, when available, price information): Major sales outlets are the Superintendent of Documents, the National Technical Information Service (NTIS), and various private publishers. Order directly from the outlet.

Available through libraries: Research publications are available through many public and university libraries in the United States and elsewhere. U.S. Government publications are also available through many Government Depository Libraries. Check with a major library near you to determine availability.

List of Categories

Publications are listed in this brochure within the following general categories:

- Anatomy and Identification
- Biodeterioration and Protection
- Energy
- Engineering Properties and Design Criteria
- Fiber and Particle Products
- Fire Safety
- General
- Microbial and Biochemical Technology
- Processing of Wood Products
- Pulp, Paper, and Packaging
- Timber Requirements and Economics
- Tropical Wood Utilization
- Wood Bonding Systems

Anatomy and Identification

1. Adapting the IAWA List of Microscopic Features for Hardwood Identification to DELTA

Espinoza de Pernia, Narcisana; Miller, Regis B.
1991. IAWA Bull. n.s. 12(1): 34–50.

The DDescription Language for Taxonomy, DELTA, is a general package of computer programs that wood anatomists can use for identifications, descriptions, and other anatomical data manipulations. We adapted the *IAWA List of Microscopic Features for Hardwood Identification* (IAWA List) to DELTA and found that it readily accepts all character types and formats outlined in the IAWA List. In addition, DELTA offers an array of flexibility including, but not limited to, the following: checking errors, reordering of characters and states, formatting descriptions, adding comments, and allowing implicit values for characters (that is, assigned state values that do not need to be repeated for every taxon).

2. Wood Anatomy of *Phragmotheca* (Bombacaceae)

Miller, Regis B.
1991. Brittonia. 43(2): 88–92.

The wood anatomy of *Phragmotheca* (Bombacaceae) is described based on three species and three specimens. The wood features of *Phragmotheca*, *Matisia*, and *Quararibea* are very similar and differ only in the size of the intervacular pits and vessel diameters. Based on wood anatomical characteristics, these three genera form a distinct and homogeneous group within both the tribe Quararibeeae and the family Bombacaceae.

Biodeterioration and Protection

3. Biological Control of Wood-Attacking Fungi Using Bacteria

Benko, Riana; Highley, Terry L.
1990. In: Llewellyn, Gerald; O'Rear, Charles E., eds. Biodeterioration Research 3: Proceedings of the 3d meeting of the Pan American Biodeterioration Society; 1989 August 3–6; Washington, DC. New York: Plenum Press: 327–332.

In this study, the effectiveness of bacteria as biological control agents against blue stain and mold fungi and brown- and white-rot decay fungi is reported.

***Meruliporia (Poria) incrassata*: Occurrence and Significance in the United States as a Dry Rot Fungus**

Burdsall, Harold H.

1991. In: Jennings, D.H.; Bravery, A.F., eds. *Serpula lacrymans*: Fundamental biology and control strategies. Chichester, West Sussex, England: John Wiley & Sons. 232 p.

Available from John Wiley & Sons Ltd., Baffins Lane, Chichester, West Sussex, PO19 1UD, England. Order No. 047193058X. Cost: \$95.75 each.

Chapters treat specific aspects of the biology of *Serpula lacrymans*, including taxonomy, culture characteristics, fruiting, and control of the decay.

4. Early Detection of Brown-Rot Decay in Southern Yellow Pine Using Immunodiagnostic Procedures

Clausen, C.A.; Green, F., III; Highley, T.L.

1991. Wood Sci. Technol. 26: 1-8.

This report compares ELISA, immuno-dot blot, and particle agglutination assays for the early detection of six brown-rot fungi on southern yellow pine (*Pinus* sp.) and correlates these methods with wood-block weight loss.

5. Biological Control of the Blue Stain Fungus *Ceratocystis coerulea* With Fungal Antagonists

Croan, Suki C.; Highley, Terry L.

1991. Mater. Org. 25(4): 255-266.

The objective of this investigation was to determine if metabolic products from white- and brown-rot basidiomycetes and *T. flavus* would inhibit growth of *Ceratocystis coerulea* (Munch) Bakeshi [C-262], a frequently found and fast-growing, primary blue stain fungi on wood.

6. Ultrastructural Morphology of the Hyphal Sheath of Wood Decay Fungi Modified by Preparation for Scanning Electron Microscopy

Green, F.; Larsen, M.; Highley, T.

1990. In: Llewellyn, Gerald C.; O'Rear, Charles E., eds. Biodeterioration Research 3: Proceedings of the 3d meeting of the Pan American Biodeterioration Society; 1989 August 3-6; Washington, DC. New York: Plenum Press: 311-325.

The purpose of this study was to extend our previous observations of the fungi by scanning electron microscopy (SEM) using diverse preparative protocols. The results presented illustrate a variety of morphological modifications of the hyphal sheath observed after fixation and dehydration for SEM. These modifications provide additional evidence for the hypothesis that the hyphal sheath is an extensive extramembranous structure.

7. Comparison of Wood Preservatives in Stake Tests: 1991 Progress Report

Gutzmer, D.I., comp.

1991. USDA Forest Serv. Res. Note FPL-RN-02. 123 p.

This progress report covers stake test results primarily from Southern Pine sapwood 2 by 4 by 18 in. in size, treated by pressure and nonpressure processes, and installed by the Forest Products Laboratory and cooperators in our decay and termite exposure sites at various times since 1938 at Saucier, Mississippi; Madison, Wisconsin; Bogalusa, Louisiana; Lake Charles, Louisiana; Jacksonville, Florida; and the Canal Zone, Panama.

8. Movement and Persistence of Chloropicrin, Vapam, and Methylisothiocyanate in Untreated Southern Pine and Douglas-Fir Timbers

Highley, Terry L.

1991. Holzforschung. 45(3): 223-228.

The objectives of this study were (1) to determine the movement, persistence, and distribution of chloropicrin, Vapam, and methylisothiocyanate in untreated horizontal Douglas-fir and Southern Pine timbers and (2) to test the efficacy of these fumigants in eradication of both brown-rot and white-rot fungi.

9. Changes in Cell Wall Components of White Pine and Maple by White-Rot Fungi

Highley, Terry L.; Illman, Barbara L.

1990. In: Llewellyn, Gerald C.; O'Rear, Charles E., eds. Biodeterioration Research 3: Proceedings of the 3d meeting of the Pan American Biodeterioration Society; 1989 August 3-6; Washington, DC. New York: Plenum Press: 349-360.

This study obtains data to establish if certain cell wall components are preferentially removed during decay and to determine if cultural parameters, such as nitrogen and carbohydrate levels, govern selectivity of removal.

10. Polyamine Biosynthesis in the Brown-Rot Fungus *Postia placenta*

Illman, Barbara L.

1990. In: Llewellyn, Gerald C.; O'Rear, Charles E., eds. Biodeterioration Research 3: Proceedings of the 3d meeting of the Pan American Biodeterioration Society; 1989 August 3-6; Washington, DC. New York: Plenum Press: 275-284.

Polyamines have not been studied in the fungi that degrade wood. The objectives of this study were to use the brown-rot fungus *Postia placenta* (Fr.) M. Lars. et Lomb. (MAD-698) as a model (1) to determine the importance of polyamines on growth of a wood-decay fungus, (2) to determine the primary biosynthetic pathway in the fungus by employing a "suicide" enzyme inhibitor, and (3) to test the efficacy of using DFMO to prevent growth and development of the fungus in wood.

11. Preservative Loss From Stakes Treated With Ammoniacal Copper Borate

Johnson, Bruce R.; Foster, Daniel O.

1991. Forest Prod. J. 41(9): 37-38.

In a previous report on field trials with stakes treated with ammoniacal copper borate, the groundline portion of stakes exposed in Mississippi for 6 years showed high boron losses. This paper looks at preservative losses from both the groundline and aboveground portions of duplicate stakes buried vertically to one-half their length for 11 years.

12. Increased Recovery of β -D-Glucosidase From *Postia placenta* in Presence of Tween Surfactants

Micales, Jessie A.

1991. Mater. Org. 26(1): 63-78.

The objective of this study was to determine whether the addition of Tween surfactants to a synthetic culture medium would influence mycelial growth and the production or secretion of extracellular carbohydrate-degrading enzymes by the brown-rot fungus *Postia placenta*.

13. Factors Associated With Decay Capacity of the Brown-Rot

Micales, J.A.; Highley, T.L.

1990. In: Llewellyn, Gerald C.; O'Rear, Charles E., eds. *Biodeterioration Research 3: Proceedings of the 3d meeting of the Pan American Biodeterioration Society*; 1989 August 3-6; Washington, DC. New York: Plenum Press: 285-302.

In this study, a morphologically atypical strain of brown-rot fungus *Postia placenta*, which produces insignificant weight losses in wood, was used to study the mechanisms of decay by brown-rot fungi.

Energy

Properties of Wood for Combustion Analysis

Ragland, K.W.; Aerts, D.J.; Baker, A.J.

1991. *Bioresour. Technol.* 37: 161-168.

Available from K. W. Ragland, Department of Mechanical Engineering, University of Wisconsin, Madison, WI 53706. No charge.

This paper will assist the combustion modeler in the difficult job of assembling property data. The paper is not a comprehensive review of all available wood fuel property data, but rather gives a data set sufficient for modeling purposes.

14. Global Warming—A Call for International Coordination

Zerbe, John I.

1991. *World Resour. Rev.* 2(1): 66-82.

This paper discusses carbon sequestration in forests and wood products, the use of wood for fuel, energy conservation through use of wood products, and reduction of atmospheric carbon through new technology. Also described are different scenarios for managing the carbon cycle and thus mitigating global warming.

Engineering Properties and Design Criteria

15. Strength and Stiffness of Spliced Nail-Laminated Posts

Bohnhoff, David R.; Moody, Russell C.

1990. In: Sugiyama, Hideo, ed. *Proceedings of the 1990 international timber engineering conference*; 1990 October 23-25; Tokyo. Tokyo: Steering Committee of the International Timber Engineering Conference: 716-722. Vol. 3.

This paper provides an overview of the research that has been conducted and proposes methods for characterizing the properties of nail-laminated posts for design.

Bending Strength and Stiffness of Wood I-Beams With Nail and Elastomeric Adhesive Bonding

Bohnhoff, D.R.; Siegel, C.E.

1991. *Trans. ASAE.* 34(1): 259-268.

Available from David R. Bohnhoff, Agricultural Engineering Department, 460 Henry Mall, University of Wisconsin, Madison, WI 53706. No charge.

Forty I-beams were fabricated from 38- by 140-mm lumber and loaded to failure in bending. To determine the influence of elastomeric adhesive, 20 beams were assembled using nails only, and 20 were fabricated using both nails and elastomeric adhesive. Thirty nail-joint specimens were also tested to determine load-slip properties for computer analysis.

16. Bending Properties of Reinforced and Unreinforced Spliced Nail-Laminated Posts

Bohnhoff, David R.; Moody, Russell C.; Verrill, Steve P.; Shirek, Leo F.

1991. *USDA Forest Serv. Res. Pap.* FPL-RP-503. 24 p.

The specific objectives of the research were (1) to determine how bending strength and stiffness of single members of dimension lumber are related to bending strength and stiffness of three-layer, unspliced nail-laminated posts; (2) to compare bending strength and stiffness of three types of three-layer nail-laminated posts: (a) unspliced, (b) spliced without butt joint reinforcement, and (c) spliced with butt joint reinforcement; and (3) to determine the effect of nail type on bending strength and stiffness of three-layer, spliced nail-laminated posts.

Timber and Timber Products: Properties, Deterioration, Protection. Chapter 4.

Bendtsen, B. Alan; Freas, Alan D.

Timber Structures. Chapter 14.

Moody, Russell C.; Freas, Alan D.

In: *Handbook of Architectural Technology.*

Cowan, Henry J., ed. New York: Van Nostrand Reinhold.

Available from Van Nostrand Reinhold, 7625 Empire Drive, Florence, KY 41042. Cost: \$79.95 each.

Written expressly for today's architect, this handbook provides a contemporary guide to materials, technologies, and techniques. Written by 25 acknowledged specialists, this authoritative volume distills the most important parts of today's existing knowledge into one concise, practical resource, offering readers vital material otherwise found in scores of separate specialty volumes. The handbook includes elementary mathematics and the physics and chemistry of building materials. The book also serves as a primer on practical subjects such as jointing, the exclusion of water, durability, and the space required for pedestrian traffic. An appendix describes both the British/American and SI metric systems of measurement and gives conversion factors between the two.

17. Wood I-Joists: A Look at Research and Production in North America

Falk, R.H.; Leichti, R.J.; Sharp, D.J.

1990. In: Sugiyama, Hideo, ed. *Proceedings of the 1990 international timber engineering conference*; 1990 October 23-25; Tokyo. Tokyo: Steering Committee of the International Timber Engineering Conference: 460-463. Vol. 2.

This paper presents an overview of important research performed on wood I-joists, examines the growth of the industry, and discusses the development of standards and the role of the Wood I-Joist Manufacturers Association.

18. Effect of Cyclic Relative Humidity on the Load Duration Behavior of Structural Lumber

Fridley, Kenneth J.; Tang, R.C.; Soltis, Lawrence A.
1990. In: Sugiyama, Hideo, ed. Proceedings of the 1990 international timber engineering conference; 1990 October 23–25; Tokyo. Tokyo: Steering Committee of the International Timber Engineering Conference: 407–415. Vol. 2.

This paper addresses the effect of several relative humidity conditions on the load-duration performance of structural lumber. The mechanosorptive effects apparent in the creep behavior of structural lumber are shown to be also present in the load-duration behavior.

19. Bending Creep and Load Duration of Douglas-Fir 2 by 4s Under Constant Load

Gerhards, Charles C.
1991. Wood Fiber Sci. 23(3): 384–409.

This paper evaluates bending creep data obtained in a comprehensive study of the effect of lumber grade on duration of constant load. It also evaluates constant load failures in wood beams during the first 3.5 years of a planned 10-year duration at near design levels of stress. Results contribute to knowledge about variations in creep characteristics of wood under both controlled and uncontrolled environments and load durations for long-time loading.

20. Lumber Property Relationships for Engineering Design Standards

Green, David W.; Kretschmann, David E.
1991. Wood Fiber Sci. 23(3): 436–456.

This paper concentrates on relationships between modulus of rupture, modulus of elasticity, ultimate tensile stress parallel to grain, and ultimate compression stress parallel to grain. The effects of lumber species, moisture content, test span, and lumber width on these relationships are discussed.

21. Moisture Content and the Flexural Properties of Lumber: Species Differences

Green, David W.; Evans, James W.; Pellerin, Roy
1991. In: Proceedings of the 1991 International timber engineering conference; 1991 September 2–5; London. London: TRADA: 2.181–2.188. Vol. 2.

This paper presents the results of a study on the effect of change in moisture content on the bending properties of lumber for five species. This study is limited to standard 38- by 89-mm (nominal 2- by 4-in.) lumber of two grades. A future paper will evaluate the applicability of analytical models recently adopted in engineering design standards to these species.

22. Effect of Moisture Content on Stress Intensity Factors in Southern Pine

Kretschmann, David E.; Green, David W.; Malinauskas, Vyto

1991. In: Proceedings of the 1991 International timber engineering conference; 1991 September 2–5; London. London: TRADA: 3.391–3.398. Vol. 3.

This paper reports the relationship between moisture content and mode I (opening) and mode II (forward shear) stress intensity factors for Southern Pine. It also presents information on specific gravity–stress intensity factor relationships as a function of moisture content.

23. Drying of Porous Materials in a Medium With Potentials Varying Exponentially With Time

Liu, Jen Y.
1991. In: Lloyd, John R.; Kurosaki, Yasuo, eds. Proceedings of the 3d ASME/JSME thermal engineering joint conference; 1991 March 17–22; Reno, NV. New York: The American Society of Mechanical Engineers: 315–323. Vol. 4.

This paper presents an application of the Luikov system of heat and mass transfer equations to predict the temperature and moisture distributions in a slab of capillary-porous material during drying. The heat and mass transfer potentials of the external medium in the boundary conditions are assumed to vary exponentially with time. The method of solution should have a general application to this type of problem with variable boundary conditions. Numerical results based on thermophysical properties of spruce are presented.

24. Drying of Porous Materials in a Medium With Variable Potentials

Liu, Jen Y.
1991. J. Heat Transfer. 113: 757–762.

This paper presents an application of the Luikov system of heat and mass transfer equations in dimensionless form to predict the temperature and moisture distributions in a slab of capillary-porous material during drying. The heat and mass potentials of the external medium in the boundary conditions are assumed to vary linearly with time. The method of solution is illustrated by considering the drying of a slab of lumber. Numerical results based on the estimated thermophysical properties of spruce are presented.

25. Solutions of Luikov Equations of Heat and Mass Transfer in Capillary-Porous Bodies

Liu, Jen Y.; Cheng, Shun
1991. Int. J. Heat Mass Transfer. 34(7): 1747–1754.

This paper presents a method of solution for the system of linear partial differential equations derived by Luikov. The Luikov system of equations is a nonlinear system because the transfer coefficients are functions of either moisture content or temperature.

26. Time-Dependent Mechanical Strength of Wood Structural Members

Liu, Jen Y.; Schaffer, E.L.
1991. In: Proceedings of the 1991 International timber engineering conference; 1991 September 2–5; London. London: TRADA: 4.164–4.171. Vol. 4.

In this paper, the authors develop improved mathematical models for time-dependent strength of wood structural members under constant- and ramp-loading conditions. The models are based on the statistical theory of absolute reaction rate, which can describe the linear as well as nonlinear behaviors between applied stress and the logarithm of time to fracture observed in test data of wood and other solids. The models contain the same physical parameters, making it possible to predict the response of wood structural members under one loading condition from that under another. Existing bending strength test data of small, clear Douglas-fir beams under constant loading, ramp loading, and impact loading are fitted with the models.

27. Strength of Glulam Beams—Volume Effects

Moody, Russell; Falk, Robert; Williamson, Thomas
1990. In: Sugiyama Hideo, ed. Proceedings of the 1990 international timber engineering conference; 1990 October 23–25; Tokyo. Tokyo: Steering Committee of the International Timber Engineering Conference: 176–182. Vol. 1.

A volume-effect relationship for use in the design of glued laminated (glulam) timber beams was developed based on an analysis of the bending strength of more than 500 Douglas-fir and Southern Pine test beams having depths up to 31-1/2 in. (0.80 m) and spans up to 48 ft (14.6 m). Proposed for adoption as a provision of an American Society of Testing and Materials standard, this design factor has a significant effect in determining the allowable design bending stresses for “large” beams.

28. Detecting Brown-Rot Decay in Southern Yellow Pine by Acousto-Ultrasonics

Patton-Mallory, Marcia; De Groot, Rodney C.
1990. In: Proceedings, 7th International nondestructive testing of wood symposium; 1989 September 27–29; Madison, WI. Pullman, WA: Washington State University: 29–44.

The objective of this research project was to apply an acousto-ultrasonic technique for nondestructively detecting brown-rot decay in softwood structural members. The scope of the research was to define waveform parameters that are sensitive to strength loss due to brown-rot decay in southern yellow pine. The experimental setup was a pilot study to evaluate two types of specimens and decay exposure conditions.

29. Field Performance of U.S. Stress-Laminated Wood Bridges

Ritter, Michael A.; Oliva, Michael G.
1990. In: Sugiyama Hideo, ed. Proceedings of the 1990 international timber engineering conference; 1990 October 23–25; Tokyo. Tokyo: Steering Committee of the International Timber Engineering Conference: 564–569. Vol. 2.

This paper presents preliminary monitoring results from six stress-laminated bridges that have been continually monitored for 1 year or more. Included are discussions related to moisture content, stressing rod force, anchorage system performance, vertical creep, load test behavior, wearing surface performance, and stressing system corrosion.

30. Methods for Assessing the Field Performance of Stress-Laminated Timber Bridges

Ritter, Michael A.; Geske, Earl A.; McCutcheon, William J.; Moody, Russell C.; Wacker, James P.; Mason, Lola E.
1991. In: Proceedings of the 1991 International timber engineering conference; 1991 September 2–5; London. London: TRADA: 3.319–3.326. Vol. 3.

A national program to improve wood utilization in bridge applications is currently being administered by the U.S. Department of Agriculture, Forest Service. As a part of this program, the USDA Forest Service, Forest Products Laboratory (FPL), has developed a bridge monitoring program to determine the field performance of timber bridges. This paper presents an overview of the methods used by the FPL to assess the field performance of stress-laminated timber bridges.

31. NDE of Green Material With Stress Waves: Preliminary Results Using Dimension Lumber

Ross, Robert J.; Pellerin, Roy F.
1991. Forest Prod. J. 41(6): 57–59.

This paper reports an experimental program designed to examine the relationship between stress wave characteristics and the static modulus of elasticity of green Douglas-fir dimension lumber. Strong correlative relationships exist between stress wave modulus of elasticity values and those obtained from static bending tests.

32. Nondestructive Testing for Assessing Wood Members in Structures: A Review

Ross, Robert J.; Pellerin, Roy F.
1991. USDA Gen. Tech. Rep. FPL–GTR–70. 27 p.

Numerous organizations have conducted research to develop nondestructive testing techniques for assessing the condition of wood members in structures. This report presents a comprehensive review of published research on the development and use of NDT tools for in-place assessment of wood members.

33. Transverse Vibration Nondestructive Testing Using a Personal Computer

Ross, Robert J.; Geske, Earl A.; Larson, Gary H.; Murphy, Joseph F.
1991. USDA Forest Serv. Res. Pap. FPL–RP–502. 17 p.

The objective of this research was to demonstrate how relatively inexpensive personal computer technology can be used to implement transverse vibration nondestructive testing techniques. We developed a data acquisition system using a personal computer capable of gathering and analyzing information from a simple transverse vibration test. This report presents the results of a comparison between modulus of elasticity values obtained from the data acquisition system we developed with those obtained from static bending tests.

34. NDE Programs at the Forest Products Laboratory

Schaffer, Erwin L.
1990. In: Proceedings, 7th International nondestructive testing of wood symposium; 1989 September 27–29; Madison, WI. Pullman, WA: Washington State University: 89–96.

Two Forest Products Laboratory research areas are currently generating the impetus for expanded nondestructive evaluation technology: (1) wood structures condition assessment and (2) product enhancement and process control. An in-house team has been formed in the Engineering Mechanics Laboratory to provide a focal point for nondestructive evaluation tool development and evaluation.

35. United States Adaptation of European Yield Model to Large-Diameter Dowel Fastener Specification

Soltis, Lawrence A.; Wilkinson, Thomas L.
1991. In: Proceedings of the 1991 International timber engineering conference; 1991 September 2–5; London. London: TRADA: 3.43–3.49. Vol. 3.

In the United States, the 1986 National Design Specifications (NDS) for laterally loaded bolted connections are based on

empirical descriptions of proportional limit load. The 1991 specifications for such connections will be based on the European Yield Model (EYM). This paper summarizes how the United States has adapted and calibrated the EYM in developing the NDS code. Subtle differences between the NDS code and the codes of other countries are described. Definition of yield point, relationship of specific gravity and dowel diameter to dowel bearing strength, standard test procedures for dowel bearing strength, verification data, and conversion factors are discussed.

36. Development of Longer Span Wood Bridges

Taylor, Raymond J.; Ritter, Michael A.

1990. In: Bakht, Baidar; Dorton, Roger A.; Jaeger, Leslie G., eds. Developments in short and medium span bridge engineering '90: Proceedings of the 3d International conference on short and medium span bridges; 1990 August 7-10; Toronto, ON, Canada. Montreal, P.Q., Canada: The Canadian Society for Civil Engineering: 391-402. Vol. 2.

This paper summarizes all the major activities that have taken place using the stressed wood system in Ontario and the United States. It represents the first stage of a cooperative program between the USDA Forest Service, Forest Products Laboratory, and the Ministry of Transportation of Ontario. These two agencies represent the centers of information and activity on the stressed wood system in the United States and Ontario, respectively. The paper briefly reviews the development of the stressed wood deck that leads into the new, longer span concepts being developed using the stressed wood system.

37. Grippend-End Effect in Tension Proof Testing of Dimension Lumber

Terry, Angela M.; Woeste, Frank E.; Bendtsen, B. Alan; Evans, James W.

1991. USDA Forest Serv. Res. Pap. FPL-RP-496. 13 p.

The objectives of this study were (1) to predict falldown of grippend-end lumber using a computer-simulated tension strength-length effect model and (2) to measure the effectiveness of tension proof testing of lumber in the light of a tripped-end effect.

38. Dowel Bearing Strength

Wilkinson, Thomas L.

1991. USDA Forest Serv. Res. Pap. FPL-RP-505. 9 p.

The European Yield Model has been proposed as a base for setting design values of laterally loaded dowel-type connections. This study investigated one input property for the model, the dowel bearing strength. Effects of specific gravity, dowel diameter, and loading direction were studied for bolts and nails.

39. Performance of Light-Frame Redundant Assemblies

Wolfe, Ronald W.

1990. In: Sugiyama Hideo, ed. Proceedings of the 1990 international timber engineering conference; 1990 October 23-25; Tokyo. Tokyo: Steering Committee of the International Timber Engineering Conference: 124-131. Vol. 1.

This paper reviews results of several studies on the evaluation of light-frame repetitive-member assembly performance. It provides limited justification for the 15-percent bending stress increase permitted for repetitive member wood frame assemblies and suggests simplified methods for evaluating assembly interaction effects on load capacity.

40. Design Equation for Multiple-Fastener Wood Connections

Zahn, John J.

1991. J. Struct. Eng. 117(11): 3477-3486.

A compact design equation is presented for the design of multiple fastener connections of wood members. It was obtained by algebraic simplification of the Lantos analysis of the unequal load sharing among fasteners in series. This equation can replace the double-entry tables now used in wood design codes. Those tables are constructed using the Lantos analysis and for simplicity have to ignore certain effects and cover only a limited range of design parameters. In addition to the specification equation, two design aids are derived: (1) a simple expression for the maximum possible capacity of a serial row of fasteners and (2) an expression for the number of fasteners required to achieve a given row capacity.

Fiber and Particle Products

41. Method for Measuring Mechanosorptive Properties

Gunderson, D.E.

1991. J. Pulp Paper Sci. 17(2): J53-J59.

Many natural fibers sorb moisture under the application of stress. This behavior is significant because it relates to the performance and durability of paper in changing environments, but adequate test methods have been lacking. In the new test method described here, sorbed moisture is continuously measured as tensile stress is applied to the specimen. The paper cites data that verify the method and compares experimental results with those predicted by the theory of Barkas.

42. An Overview of Press-Drying, Impulse-Drying, and Condebelt-Drying Concepts

Gunderson, Dennis E.

1991. In: Proceedings of the Helsinki symposium on alternate methods of pulp and paper drying; 1991 June 4-7; Helsinki. Helsinki: Multiprint: 61-77.

This overview paper addresses the basic concepts that initiated and still underlie research in press-drying, condensing-belt, and impulse-drying means. The author sees press-drying development stalled, for lack of research of sufficient focus and scope to yield a definitive process model, apparatus design, and economic assessment. He interprets patent activity and reports from Tampella as suggesting that Condebelt development continues to progress and discusses ongoing work in impulse-drying development in three areas: validity of the blow-through mechanism, web delamination, and two sidedness of the dried sheet. The eventual, successful development of advanced drying systems is predicted based on an amalgamation of the three areas.

43. Alternative Uses of Recovered Fibers

Hamilton, Thomas E.; Youngquist, John A.;

Baker, Andrew J.; Rowell, Roger; Laufenberg, Theodore L.; Collet, Mary P.

1991. In: Focus '95+ Landmark paper recycling symposium proceedings; 1991 March 19-21; Atlanta, GA. Atlanta, GA: TAPPI: 333-341.

The overall goal of this paper is to describe potential ways for using recovered wood fibers from industrial operations or the municipal solid waste stream for the production of useful

commodities. Alternative, value-added uses for waste fibers and selected research results and industrial developments using these materials are described, and high-priority research and development needs for maximizing the benefits of using recovered fibers are identified.

44. Creep and Creep-Rupture of Plywood and Oriented Strandboard

McNatt, J. Dobbin; Laufenberg, Theodore L.

1991. In: Proceedings of the 1991 International timber engineering conference; 1991 September 2-5; London. London: TRADA: 3.457-3.464. Vol. 3.

This paper discusses the USDA Forest Service, Forest Products Laboratory, portion of a joint U.S.-Canada research program developed in cooperation with Forintek Canada Corp., the American Plywood Association, and the Waferboard Association (now the Structural Board Association). The objectives for this baseline study of flexural creep-rupture in wood-based panel products were to provide (1) a consistent database of properties to characterize the rheological behavior of commercial wood-based panels, (2) analytical methods for describing and predicting their behavior, and (3) guidance for future research in this area.

45. Chemical Modification of Wood

Rowell, Roger M.

1991. In: Hon, David N.-S.; Shiraishi, Nobuo, eds. Wood and cellulosic chemistry. New York: Marcel Dekker, Inc.: 703-756. Chapter 15.

This chapter reviews many different chemical systems that have been applied to wood and shows where bonding has taken place in the cell wall polymers. Major emphases are examining changes in properties resulting from chemical modification and to consider the realistic future of the technology.

46. High Performance Composites Made From Chemically Modified Wood and Other Lignocellulosic Fibers

Rowell, Roger M.

1991. In: 6th International symposium on wood and pulping chemistry proceedings; 1991 April 30-May 4; Melbourne, Victoria, Australia. Melbourne, Victoria, Australia: Australian Pulp and Paper Industry Technology Association: 341-344. Vol. 1.

High-performance wood and other lignocellulosic composites with uniform densities, durability in adverse environments, and high strength can be produced using fiber technology, high-performance adhesives, and fiber modification to overcome dimension instability, biodegradability, flammability, and degradation caused by ultraviolet light, acids, and bases. The wide distribution, renewability, and recyclability of lignocellulosics can expand the market for low-cost composites and high-performance materials. This paper discusses the composition of lignocellulosics, the properties of lignocellulosic composites and modification of these properties, and the future of lignocellulosic composites.

47. Technologies for Rapid Production of Mineral-Bonded Wood Composite Boards

Simatupang, Maruli H.; Seddig, Norbert; Habighorst, Christoph; Geimer, Robert L.

1990. In: Moslemi, Al, ed. Inorganic bonded wood and fiber composite materials: Proceedings of the 2d

international inorganic bonded wood and fiber composite materials conference; 1990 October 14-17; Moscow, ID. Madison, WI: Forest Products Research Society: 18-27.

In this paper, existing technologies that reduce the production time of gypsum, magnesia, and portland cement-bonded wood composite boards are reviewed. Experimental data that verify these technologies are given, and new concepts are presented.

Fire Safety

48. The Role of Boron in Flame-Retardant Treatments

LeVan, Susan L.; Tran, Hao C.

1990. In: Hamel, Margaret, ed. 1st International conference on wood protection with diffusible preservatives: Proceedings 47355; 1990 November 28-30; Nashville, TN. Madison, WI: Forest Products Research Society: 39-41.

Flame retardants for wood alter the combustion properties of wood to reduce surface flame spread. Flame retardant chemicals cause acid catalyzed dehydration reactions in wood to facilitate the formation of char and reduce the effective heat of combustion, resulting in lower heat release and flame spread. Boron compounds can also form glassy films that may inhibit mass transfer of combustible vapors. This paper discusses the role of boron in providing flame retardancy to wood.

49. Experimental Aspects of Validating a Compartment Wall Fire Model

Tran, Hao C.

1990. In: Proceedings, 5th International fire conference, Interflam '90; 1990 September 3-6; Canterbury, England. London, England: Interscience Communication Limited: 13-24.

This paper describes some experimental aspects of the fire growth research program, highlights some research findings, and reports on progress of the compartment wall fire model under development.

50. Thermal Degradation of Fire-Retardant-Treated Plywood: Development and Evaluation of a Test Protocol

Winandy, Jerrold E.; LeVan, Susan L.; Ross, Robert J.; Hoffman, Scott P.; McIntyre, Craig R.

1991. USDA Forest Serv. Res. Pap. FPL-RP-501. 21 p.

This paper describes the development and evaluation of a new test protocol for screening potential fire-retardant treatments for plywood that is continuously or periodically exposed to elevated temperatures.

51. Fire-Retardant-Treated Wood: Research at the Forest Products Laboratory

Winandy, Jerrold E.; Ross, Robert J.; LeVan, Susan L.

1991. In: Proceedings of the 1991 International timber engineering conference; 1991 September 2-5; London. London: TRADA: 4.69-4.74. Vol. 4.

This paper describes the research program underway at the USDA Forest Service, Forest Products Laboratory, Madison, Wisconsin, that was designed to examine mechanisms of thermal-induced degradation in fire-retardant-treated lumber and plywood. It also

reviews results from our research program on chemical, mechanical, and nondestructive evaluations of untreated and fire-retardant-treated wood exposed to elevated temperatures.

General

52. Characterization of Canadian Arctic Fossil Woods

Obst, J.R.; McMillan, N.J.; Blanchette, R.A.; Christensen, D.J.; Faix, O.; Han, J.S.; Kuster, T.A.; Landucci, L.L.; Newman, R.H.; Pettersen, R.C.; Schwandt, V.H.; Wesolowski, M.F.
1991. In: Tertiary Fossil Forests of the Geodetic Hills, Axel Heiberg Island. Arctic Archipelago. R.L. Christie and N.J. McMillan, eds. Geological Survey of Can. Bull. 403: 123-146.

This report describes a single wood specimen of Paleocene age from Hot Weather Creek on Ellesmere Island, a suite of 10 specimens of Eocene age from the Geodetic Hills on Axel Heiberg Island, and a single specimen, possibly of Miocene age, from Cornwallis Island.

Microbial and Biochemical Technology

53. Proton NMR Investigation Into the Basis for the Relatively High Redox Potential of Lignin Peroxidase

Banci, Lucia; Bertini, Ivano; Turano, Paola; Tien, Ming; Kirk, T. Kent
1991. Proc. Natl. Acad. Sci. USA. 88: 6956-6960.

Lignin peroxidase shares several structural features with the well-studied horseradish peroxidase and cytochrome c peroxidase but carries a higher redox potential. Here the heme domain of lignin peroxidase and the lignin peroxidase cyanide adduct was examined by ^1H NMR spectroscopy, including nuclear Overhauser effect and two-dimensional measurements, and the findings were compared with those for horseradish peroxidase and cytochrome c peroxidase. Structural information was obtained on the orientation of the heme vinyl and propionate groups and the proximal and distal histidines.

54. Regulation of Ligninase Production in White-Rot Fungi

Bonnarme, Pascal; Perez, Juana; Jeffries, Thomas W.
1991. In: Leatham, Gary F.; Himmel, Michael E., eds. Enzymes in biomass conversion: Proceedings of a symposium; 1990 April 22-27; Boston, MA. ACS symposium series 460. Washington, DC: American Chemical Society: 200-216. Chapter 16.

Carbon, nitrogen, and manganese are critical nutritional variables in the production of ligninases including lignin peroxidase (LiP) and manganese peroxidase (MnP) by *Phanerochaete chrysosporium* and other white-rot fungi. Excess carbon and nitrogen repress lignin biodegradation. Mn(II) is a specific effector that induces MnP and represses LiP. LiP and MnP also have different sensitivities to carbon and nitrogen supply. Mn(II) regulation is superimposed on carbon and nitrogen regulation and is only apparent when cultures are derepressed for these macronutrients. Supplementing nitrogen during cultivation represses MnP activity but can stimulate LiP production. These findings suggest that the regulatory mechanisms for LiP and MnP isoenzymes differ in several ways.

55. Characteristics of Cotton Cellulose Depolymerized by a Brown-Rot Fungus, by Acid, or by Chemical Oxidants

Kirk, T. Kent; Ibach, Rebecca; Mozuch, Michael D.; Conner, Anthony H.; Highley, Terry L.
1991. Holzforschung. 45(4): 239-244.

The purpose of the present research was to gain insight into the biochemical mechanism of depolymerization by characterizing cellulose that had been degraded by a brown-rot fungus in the solid substrate system. The fungus-depolymerized cellulose was compared with acid-depolymerized cellulose, with cellulose oxidized and depolymerized by the Fenton reagent, and with cellulose oxidized and depolymerized by periodic acid and bromine water.

56. Oxidation of Methoxybenzenes by Manganese Peroxidase and by Mn^{3+}

Popp, Janet L.; Kirk, T. Kent
1991. Archives Biochem. Biophys. 288(1): 145-148.

Manganese peroxidase, produced by some white-rot fungi during lignin degradation, catalyzes the oxidation of Mn^{2+} to Mn^{3+} . Whereas Mn^{3+} is known to oxidize phenolic compounds, its role in lignin degradation is not clear. We have used a series of methoxybenzenes with $E_{1/2}$ values of 1.76-0.81 V (versus saturated calomel electrode) to investigate the oxidizing ability of Mn^{3+} chelates generated chemically and enzymatically.

Processing of Wood Products

57. IMPROVE Your Lumber Drying

Danielson, Jeanne D.; Milota, Michael R.; Boone, R. Sidney; Huber, Dean W.
1990. In: Proceedings, Western Dry Kiln Association joint meeting 1990 May 9-11; Reno, NV. Corvallis, OR: Western Dry Kiln Association: 22-24.

Objectives of the IMPROVE Lumber Drying Program are to provide easy-to-use methods and techniques that a kiln operator can use routinely in the course of normal work around the kilns without doing special studies or interfering with production. To help meet these objectives, we have written a checklist and guidebook for softwood quality (item 59).

58. Thermogravimetry of Wood Reacted With Hexamethylphosphorus Triamide as a Flame Retardant Treatment

Ellis, W.D.
1991. Thermochimica Acta. 188: 213-219.

Specimens of pine were reacted with hexamethylphosphorus triamide (HMPT) in dimethylformamide solutions. The specimens were evaluated using thermogravimetry for their potential fire resistance. This research describes the potential of using HMPT as a reactive flame retardant for wood.

59. Quality Drying of Softwood Lumber: Guidebook-Checklist

Milota, Michael R.; Boone, R. Sidney; Danielson, Jeanne D.; Huber, Dean W.
1991. USDA Forest Serv. Gen. Tech. Rep. FPL-IMP-GTR-1. 50 p.

The IMPROVE Lumber Drying Program is intended to increase awareness of the lumber drying system as a critical component in the manufacture of quality lumber. One objective of the program is to provide easy-to-use tools that a kiln operator can use to maintain an efficient kiln operation and therefore contribute to lumber drying quality. This report is one component of the IMPROVE Program. It contains a guidebook-checklist for drying quality softwood that kiln operators or management can use to readily evaluate how well their operations rate on those factors that most strongly affect drying quality, with particular emphasis on kiln operation and maintenance and lumber handling.

60. Dependence of the Water Vapor Diffusion Coefficient of Aspen (*Populus spec.*) on Moisture Content

Simpson, W.T.; Liu, J.Y.

1991. Wood Sci. Technol. 26: 9-21.

This paper presents a correct and improved application of Crank and Park's 1949 mathematical technique and reanalyzes Simpson's 1974 experimental data to determine the relationship between diffusion coefficient and moisture content of aspen at 43°C.

61. An Examination of Knife Pitch Settings for Rotary Peeling

Spelter, Henry

1991. Panel World. July: 32-35.

Three knife pitch configurations are examined and compared to a reference pitchrail that was empirically found to yield good results. Of the three, the one based on constant length of rub matches the reference curve the best.

Pulp, Paper, and Packaging

62. The U.S. Pulp and Paper Model

Ince, Peter J.

1990. In: Proceedings of the 19th World congress; 1990 August 5-11; Montreal, Canada. Quebec, Canada: Canadian IUFRO world congress organizing committee: 428-432.

The U.S. Pulp and Paper Model is an economic model of the pulp and paper sector. It simulates the adoption of new pulp and paper manufacturing processes and simultaneously projects the prices and quantities of pulpwood and wastepaper consumed in the United States and Canada. The model encompasses production and trade of the United States and Canada with respect to each principal grade of pulp, paper, and paperboard, hardwood and softwood pulpwood, and several grades of recycled wastepaper. This report describes the context in which the U.S. Pulp and Paper Model is being developed, and provides a general description of methods and research that are being incorporated in the model.

63. Application of Modern Liquid-State NMR Techniques to Lignin Characterization

Landucci, Lawrence L.

1991. In: Proceedings, 6th International symposium on wood and pulping chemistry; 1991 April 30-May 4;

Melbourne, Victoria, Australia. Melbourne, Victoria, Australia: Australian Pulp and Paper Industry Technology Association: 375-380. Vol. 1.

In this paper, the following aspects of ^{13}C NMR spectroscopy of lignin are discussed: (a) factors affecting signal resolution and realistic limits that may be expected, (b) use of a lignin model database in the complete assignment of signals of p-acetoxybenzoate structures in acetylated willow (*Salix alba*) milled-wood lignin and their quantitation by a spectral simulation technique, and (c) assignment of some signals resulting from protonated aromatic carbons in syringyl units by use of a selective excitation technique.

64. ^{13}C NMR Technique for Discriminating High and Low Molecular Weight Components

Landucci, Lawrence L.

1991. In: Proceedings, 6th International symposium on wood and pulping chemistry; 1991 April 30-May 4; Melbourne, Victoria, Australia. Melbourne, Victoria, Australia: Australian Pulp and Paper Industry Technology Association: 341-344. Vol. 2.

A simple and convenient method of separating the structural features associated with low molecular weight components from the ^{13}C nuclear magnetic resonance data of lignin products is described.

65. Papermaking Properties of Aspen Ultrahigh-Yield Mechanical Pulps

McGovern, J.N.; Wegner, T.H.

1991. Tappi J. August: 157-161.

The objectives of this study were to determine and evaluate the chemical composition (including sodium and sulfur content), handsheet strengths, fiber length indices, optical properties, and fiberizing energies of 11 types of aspen ultrahigh-yield mechanical pulps.

66. Location of Lignin-Bonded Pectic Polysaccharides

Minor, James L.

1991. J. Wood Chem. Tech. 11(2): 159-169.

This paper reports on a very high-yield loblolly pine (*Pinus taeda*) kraft pulp that was separated into middle-lamella-rich and secondary-wall-rich fractions. The separate fractions were treated with polysaccharidases and then analyzed for the carbohydrate structures retained with the lignin residue.

67. Improved Penetration of Pulping Reagents Into Wood

Minor, James L.; Springer, Edward L.

1991. In: Proceedings, 6th International symposium on wood and pulping chemistry; 1991 April 30-May 4; Melbourne, Victoria, Australia. Melbourne, Victoria, Australia: Australian Pulp and Paper Industry Technology Association: 389-395. Vol. 1.

Pretreatment of hardwood chips or sticks with alkali increased the permeability of the wood and increased the rate of diffusion of water-soluble materials. Commercial-size hardwood (aspen, red

alder, and red oak) chips were pulped with peroxymonosulfuric acid solutions to give bright pulps with very low lignin content, high viscosity and kraft quality strength.

68. Effect of Wood Particle Size on Fungal Growth in a Model Biomechanical Pulping Process

Sachs, Irving B.; Blanchette, Robert A.; Cease, Kory R.; Leatham, Gary F.

1991. *Wood Fiber Sci.* 23(3): 363-375.

The pretreatment of aspen wood chips with white-rot fungus has been evaluated as a way of making biomechanical pulp. This study addressed (1) whether wood particle size (chip size) affects the growth pattern of the attacking organism and (2) whether the difference in particle size between chips and coarse pulp is related to the availability of wood polymers to the fungus.

Timber Requirements and Economics

69. Timber Market Implications of Recycling

Ince, Peter J.

1991. In: Focus '95+ Landmark paper recycling symposium proceedings; 1991 March 19-21; Atlanta, GA. Atlanta, GA: TAPPI: 51-60.

This paper contains the most recent Forest Service long-range projections of timber market implications of recycling. Impacts on paper and board production, pulpwood consumption, and pulpwood markets are projected into the 21st century. Also projected are impacts on sawtimber markets and lumber production. Impacts on sawtimber markets are compared with projected impacts of implementing a conservation strategy for the northern spotted owl.

70. Regional Projections of Employment and Wages in the Softwood Lumber and Plywood Industries

Lange, William J.; Skog, Kenneth E.; Plantinga, Andrew J.; Spelter, Henry

1990. In: *Forestry on the frontier: Proceedings of the 1989 national convention of the Society of American Foresters*; 1989 September 24-27; Spokane, WA. Bethesda, MD: Society of American Foresters: 265-269.

Technological change is expected to play an important role in the development of the softwood lumber and plywood industries over the next 50 years. To measure this effect, process models developed at the Forest Products Laboratory were used to make regional projections of employment and wages to 2040 for the softwood lumber and plywood industries.

71. Potential Timber Market Impact of Current Wood Utilization Research

Skog, Kenneth; Durbak, Irene; Howard, James; Spelter, Henry; Adams, Darius; Haynes, Richard

1991. *Forest Prod. J.* 41(7/8): 44-52.

As part of the USDA Forest Service 1989 timber assessment, an analysis has been conducted of the potential impact of seven areas of current Forest Service wood utilization research on timber and wood products markets. Prices, consumption, total annual value, and present (discounted) value were studied.

Tropical Wood Utilization

72. Delegates Add 2 Years to Tropical Timber Group

Indell, Gary

1991. *World Wood.* 32(5): 6.

This news article announces the 2-year extension of the International Tropical Timber Organization (ITTO) 1983 Agreement. The article also summarizes the 10th meeting of ITTO held in Quito, Ecuador.

73. Relative Drying Time of 650 Tropical Woods: Estimation by Green Moisture Content, Specific Gravity, and Green Weight Density

Simpson, William T.; Sagoe, John A.

1991. USDA Forest Serv. Gen. Tech. Rep. FPL-GTR-71. 27 p.

This report examines the relationship between green moisture content and specific gravity of tropical species, using data gathered from the world literature. The report shows how these data, converted to green weight density, can be used to estimate drying times and thus to group tropical species by similar estimated drying times.

Wood Bonding Systems

74. Polyamine-Modified Urea-Formaldehyde Resins. I. Synthesis, Structure, and Properties

Ebewele, Robert O.; Myers, George E.; River, Bryan H.; Koutsky, James A.

1991. *J. Appl. Poly. Sci.* 42: 2997-3012.

The objective of this study was to improve the durability and stability of urea-formaldehyde-bonded wood products by decreasing the internal stress developed during resin cure and by improving the ability of the cured resin to withstand cyclic stresses. This paper presents initial results from modifying an urea-formaldehyde resin by incorporating di- and trifunctional amines.

75. Polyamine-Modified Urea-Formaldehyde Resins. II. Resistance to Stress Induced by Moisture Cycling of Solid Wood Joints and Particleboard

Ebewele, Robert O.; River, Bryan H.; Myers, George E.; Koutsky, James A.

1991. *J. Appl. Polym. Sci.* 43: 1483-1490.

The objective of this study was to improve the durability and stability of urea-formaldehyde-bonded wood products by decreasing the internal stress developed during resin cure and by improving the ability of the cured system to withstand cyclic stresses.

76. Computational Chemical Studies on the Formation of Difurfuryl Amines

Elder, Thomas; Conner, Anthony H.

1991. In: *Proceedings, 6th International symposium on wood and pulping chemistry*; 1991 April 30-May 4;

Melbourne, Victoria, Australia. Melbourne, Victoria, Australia: Australian Pulp and Paper Industry Technology Association: 11-14. Vol. 1.

The objectives of this paper are concerned with a detailed examination of the reactions leading to difurfuryl amines. Molecular orbital calculations have been used to study the reactions of furfuryl amine and a range of carbonyl compounds to help explain the differential reactivities observed experimentally. The distribution of electrons and charge densities in frontier molecular orbitals are used as reactivity indices. Heat of formation data are also used to elucidate thermodynamically preferred mechanisms.

77. Resin Characterization

Geimer, Robert L.; Follensbee, Robert A.; Christiansen, Alfred W.; Koutsky, James A.; Myers, George E.
In: Proceedings of the 24th WSU International particle-board/composite materials symposium; 1990 April 3-5; Pullman, WA. Pullman, WA: Washington State University: 65-83.

Currently, thermosetting adhesives are characterized by physical and chemical features such as viscosity, solids content, pH, and molecular distribution, and their reaction in simple gel tests. Synthesis of a new resin for a particular application is usually accompanied by a series of empirical laboratory and plant trials. The purpose of the research outlined in this paper was to develop techniques that could be used to characterize thermosetting resins by their time-dependent reaction to the environmental conditions—temperature and moisture—that influence both cure and bonding.

78. Wood Flour/Polypropylene Composites: Influence of Maleated Polypropylene and Process and Composition Variables on Mechanical Properties

Myers, G.E.; Chahyadi, I.S.; Coberly, C.A.; Ermer, D.S.
1991. Intern. J. Polymeric Mater. 15(1): 21-44.

The mechanical properties of wood flour/polypropylene composites may be improved by using coupling agents to enhance the bonding between filler and matrix. A two-level, full-factorial experiment was used to examine the effectiveness of a commercially available additive, Epolene E-43, on strength (tensile, flexural, and cantilever-beam), modulus, impact energy, density, and melt viscosity of composites. The effect of Epolene E-43 was studied alone and in combination with three other variables: the weight ratio of wood flour to total polymer in the composites (45/55 or 55/45), size of wood flour particles (nominal 20 or 40 mesh), and extruder residence time (one or three extrusions).

79. Phenol-Formaldehyde Resin Curing and Bonding in Steam-Injection Pressing. I. Resin Synthesis, Characterization, and Cure Behavior

Myers, George E.; Christiansen, Alfred W.; Geimer, Robert L.; Follensbee, Robert A.; Koutsky, James A.
1991. J. Appl. Polym. Sci. 43: 237-250.

Two different phenol-formaldehyde resole resins are serving as models in a study aimed at establishing the effects of moisture, temperature, pressure, and time on resin cure and bonding during

the pressing of wood flakeboard. This phase of the program had two goals: first, to characterize the two resins in terms of their structure and chemistry during synthesis, aging, and cure—using viscosity measurement, gel permeation chromatography, nuclear magnetic resonance, differential scanning calorimetry (DSC), Fourier transform infrared spectroscopy (FTIR), and dynamic mechanical analysis (DMA); second, to make a preliminary evaluation of the utility of DSC, FTIR, and DMA for measuring the degree of resin cure.

Wood as an Adherend

River, Bryan H.; Gillespie, Robert H.; Vick, Charles B.
1991. In: Minford, J. Dean, ed. Treatise on adhesion and adhesives. New York, NY: Marcel Dekker, Inc. 528 p. Vol. 7.

Available from Marcel Dekker, Inc., 270 Madison Avenue, New York, NY 10016. Cost: U.S. and Canada, \$165.00; all other countries, \$189.75.

Volume 7 presents complete, state-of-the-art coverage of commercially preferred adhesives and surface pretreatments for joining wood and wood derivatives, rubbers and elastomers, plastics, and titanium. This reference is a good tool for polymer and surface chemists; materials scientists; mechanical, industrial, manufacturing, and chemical engineers; forest products researchers; and upper-level undergraduate and graduate students in these disciplines.

80. Acetylated, Isocyanate-Bonded Flakeboards After Accelerated Aging

Vick, C.B.; Krzysik, A.; Wood, J.E., Jr.
1991. Holz als Roh- und Werkstoff. 49: 221-228.

The purpose of this study was to fabricate a highly durable flakeboard for exterior service that would remain dimensionally stable and decay resistant and retain high levels of strength properties and surface integrity for long-term exposure.

Special Item

Dry Kiln Operator's Manual

Simpson, William T., ed.
1991. USDA Forest Serv. Agric. Handb. 188. 274 p.

Available from Superintendent of Documents, Mail Stop SSOP, Washington, DC 20402-9328. Stock No. 001-000-04576-8. Cost: \$14.00 each.

This manual is a revision of the 1961 edition. It describes both the basic and practical aspects of kiln drying lumber and is intended for several types of audiences. First, it is intended as a practical guide for the kiln operator. Mill managers will find it useful in understanding the importance and complexity of lumber drying and thus be able to offer kiln operators the support they need to do their job well. Finally, the manual is intended as a classroom text—either for a short course on lumber drying or for the wood technology curriculum in universities or technical colleges. A glossary is included to assist the newcomer with the generally accepted industry terminology used in this manual.

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